NanoRacks Customer Payloads on Orbital-ATK-9

NANORACKS CUBESAT DEPLOYER (INTERNATIONAL SPACE STATION)

NASA ELaNa 23, CubeRRT – Ohio State University, Columbus, Ohio 6U

CubeRRT will be delivered by the Orbital ATK Cygnus-9 resupply spacecraft and deployed sometime in the following month. CubeRRT is a part of four projects selected for the In-Space Validation of Earth Science Technologies (InVEST) program within NASA's Earth Science Division.

CubeRRT will assist in demonstrating RFI technologies for earth-sensing microwave radio meters. This will enable scientists to remotely sense properties like soil moisture, sea surface temperature, atmospheric water vapor, sea surface winds, and others. The missions will fly in space as part of a 6U CubeSat. It was selected in 2015 by NASA to be launched as part of the ELaNa program.

NASA ELaNa 23, EQUiSat – Brown University, Providence, RI 1U

EQUiSat will be deployed as a low-cost DIY CubeSat and educational outreach mission. Brown Space Engineering will preserve EQUiSat as a low-cost and documented open source project. This will allow for others unaffiliated with the project to utilize EQUiSat's subsystems without dedication of large budgets or extensive expertise. Total cost to build/reproduce EQUiSat is roughly $5,000.

EQUiSat's secondary mission is to test viability of LiFePO 4 Batteries. LiFePO 4 batteries have never been flown in space, but as they have high current draw capabilities and less risk of thermal runaway than opposing lithium-ion batteries, the advantages it carries over conventional batteries is worth noting. The primary payload of EQUiSat is a high-power LED, which will flash and be visible from Earth, and be as bright as the North Star. The second payload is the LiFePO 4 batteries, which will power the first payload, the LED array. It was selected in 2015 by NASA to be launched as part of the ELaNa program.

NASA ELaNa 23, HaloSat – University of Iowa 6U

HaloSat is in collaboration with the University of Iowa and NASA when the project was selected in August 2015. HaloSat will be equipped with X-Ray detectors to discover if there is a hot baryon gas halo around our galaxy. The goal of this mission is to map the distribution of the hot baryon gas surrounding the Milky Way and to determine whether it fills an extended halo or if it is compact, with no contributing mass to the galaxy.

The payload consists of three XR-100SDD X-ray detectors (silicon drift defectors – SSDs). This also includes three redundant detectors that include an SDD, X-ray collimator, anti-coincidence shield, and all electronics. This dedicated CubeSat enables an instrument design and strategy to maximize the detection of the halo signal, while subsequently minimizing possible foregrounds from solar wind charge exchange interactions. It was selected in 2015 by NASA to be launched as part of the ELaNa program.

NASA ELaNa 23, MemSat – Rowan University, Glassboro, NJ 1U

Memristor Satellite (MemSat) is developed by Rowan University to fly a memristor evaluation payload. Memristors are electronic devices which information is stored within the resistance state of the device and can be retained during power-off modes. This will allow for energy efficient power management and system resiliency in power failures.

The mission is to relate and illustrate the behavior of memristor memory devices against silicon-based memory technologies. This is to determine possible advantages or disadvantages of memristors for space applications. It was selected in 2015 by NASA to be launched as part of the ELaNa program.

NASA ELaNa 23, RadSat-g – Montana State University, Bozeman, MT 3U

The RadSat-g (Radiation Satellite) is a mission developed by Montana state University as a tech demonstration. The demonstration consists of a new radiation tolerant computer system in low earth orbit to demonstrate TRL(Technology Readiness Level)-9 of the technology.

The payload is a radiation tolerant computer system, as well as a radiation sensor. To make Field Programmable Gate Arrays less susceptible to effects caused by a single event, the computer system achieves radiation tolerance through a variety of fault mitigation approaches. These fault mitigation approaches are novel strategies to recover from possible failures caused by high energy ionizing radiation. It was selected in 2015 by NASA to be launched as part of the ELaNa program.

NASA ELaNa 23, RainCube – JPL, Pasadena, CA 6U

RainCube (Radar CubeSat) is a mission developed by JPL, sponsored by NASA's Earth Science Technology Office through the InVEST-15 program, which will demonstrate Ka-band precipitation radar technologies on a low-cost, quick-turnaround platform. RainCube developed a radar payload operating at 35.75 GHz as well as an ultra-compact and light deployable Ka-band antenna in order to raise the TRL (technology readiness level) of the radar and antenna from 4-7 within the life of the program, which is three years. RainCube will demonstrate the feasibility of

the radar payload on a CubeSat platform. It was selected in 2015 by NASA to be launched as part of the ELaNa program.

NASA ELaNa 23, TEMPEST-D,1 – Colorado State University, Fort Collins, CO 6U

TEMPEST-D,1 (Temporal Experiment for Storms and Tropical Systems – Demonstrator) is a mission designed to provide risk mitigation for the TEMPEST mission that includes six satellites. TEMPEST-D,1 will provide first temporal observations of cloud and precipitation processes on a global scale. This is significant because TEMPEST will allow for the understanding of the linkages between Earth's water and energy balance and help us to improve our understanding of how cloud model microphysical processes are necessary to predict climate change.

TEMPEST-D,1 is one of the proposed TEMPEST 6U CubeSats, that will raise the TLR (Technology Readiness Level) to TLR-9, and to demonstrate measurement capabilities. The payload of TEMPEST-D,1 will consist of the JPL radiometer developed for the failed RACE mission, as well as an High-frequency Airborne Microwave and Millimeter-wave Radiometer (HAMMR) IIP-10 radiometer. It was selected in 2015 by NASA to be launched as part of the ELaNa program.

EnduroSat – EnduroSat 1U

EnduroSat is a multipurpose CubeSat platform engineered for space application and research. The EPS+ and solar panels will provide power for the mission. Two UHF Transceiver type II and the UHF deployable antenna will deliver a high-reliable communication system for TT&C and data. A network of actuators and sensors will enable spacecraft control and processing capabilities will be provided through the low power consuming and high performance Onboard computer.

Radix – Analytical Space 6U

The spacecraft's primary mission will be a demonstration of the concept of operations for a RF-optical data relay. The CubeSat shall receive transmission in RF (S-band) from the ground and/or from beta-test customer spacecraft already on orbit and store the data on board. The CubeSat shall downlink the data to the ground using laser communication.

The mission objectives are to prove the utility of a data relay service for current satellite operators. Increasing the data throughput for current and future satellite users will greatly increase earth observation and monitoring science downlinked to scientific and commercial users. This can increase mission payload utility for any customer satellite operator.

NANORACKS EXTERNAL CYGNUS SATELLITE DEPLOYMENTS

Spire Lemurs (4 satellites) – (3U each)

Spire has launched 23 cubesats via ISS missions. In total, 67 Spire 3U cubesats have been successfully placed into orbit since 2014. The satellites are multi-sensor and serve a wide array of applications including global ship, plane, and weather tracking.

More than 90% of global trade transits over the ocean yet 50 nautical miles away from land, the signal no longer reaches land-based antennae. Spire's satellites, however, pick up these signals from space then relay the information down via a global ground station network to pinpoint the ships exact location. Access to this data has a large impact on the world's economy - in particular shipping, logistics, commercial fishing, defense, and more.

Demand for accurate weather data is increasing as more people and businesses around the globe are impacted more frequently and more severely by the weather. At the same time supply is declining, as governments reduce costly weather data collection programs. On the other side of the forecasting equation, weather models continue to improve. For organizations around the world, Spire provides a cost effective, global radio occultation (RO) weather data feed to augment existing data and improve the accuracy of the world's best forecast models.

In the aftermath of the Flight 370 incident, ADS-B, a standard of aircraft tracking in aviation, is set to become mandatory as tracking mandates worldwide begin taking effect from now into 2020. These satellites, carrying Spire's ADS-B sensor, will work to fill the gaps in our understanding of plane travel.

NanoRacks-LEMUR-2 further enables Spire's iterative improvement model to validate and improve elements of its technology while in production (for example, antenna deployment mechanisms, satellite-to-ground communications link, sensors, software, etc.), as well as improving its market offering for maritime, aviation, and weather data.

NanoRacks-LEMUR-2 allows Spire to validate specific elements of its technology (for example, antenna deployment mechanisms, satellite-to-ground communications link, etc.), as well as its market offering for maritime and weather data. With results from this research, Spire will begin deployment of its full constellation of satellites to deliver near real time updates on maritime and weather data from anywhere on Earth

AeroCube 12A & B (Two Satellites) – Aerospace Corp 3U (each)

The AeroCube 12 (AC12) program consists of two nearly-identical spacecraft, AeroCube 12 A&B (AC12-A and AC12-B), that will demonstrate new star-tracker imaging sensors, a variety of nanotechnology payloads, advanced solar cells, and an electric propulsion system on one of the two satellites (AC12-B). The experiments performed with the AC12 program will build upon technologies tested on the AC8 CubeSats which were launched in 2015 and 2016.

# # #

Media Contact – Abby Dickes, adickes@nanoracks.com

Follow us on Twitter @NanoRacks